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贵州兴义中三叠统法郎组竹杆坡段 *Lariosaurus* 一新种[1)]

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摘要 记述了贵州兴义法郎组竹杆坡段鸥龙的一新种——兴义鸥龙(*Lariosaurus xingyiensis* sp. nov.)。兴义鸥龙以其上颞孔是眼眶长度的两倍,顶骨平台细长而不收缩,肱骨缺失外髁沟和旋后肌突,及肱骨短于股骨而有别于鸥龙的其他种。兴义鸥龙与意大利拉丁晚期的 *Lariosaurus valceresii* 最为相似。依据脊椎动物的对比,法郎组竹杆坡段的时代应为中三叠世晚期。

关键词 贵州兴义,中三叠世,幻龙科

中图法分类号 Q915.864

贵州兴义是中国最早发现的三叠纪鳍龙类化石产地。1958年杨钟健记述了发现于法郎组竹杆坡段肿肋龙科(Pachypleurosauridae)的胡氏贵州龙(*Keichousaurus hui* Young, 1958),认为它与产自欧洲中三叠世的 *Pachypleurosaurus* 及 *Neusticosaurus* 关系密切。意外兴义龙(*Shingyisaurus unexpectus*)是杨钟健(1965)在一不完整头骨的基础上建立的,当时归入扁鼻龙科(Simosauridae)。后经 Rieppel(1998)再研究,依据其尖锐而弯曲的锥状牙齿,后置的松果孔,及在上颞孔前缘之后的额骨—顶骨骨缝,将其看作是幻龙科(Nothosauridae)幻龙属的未定种(*Nothosaurus* sp.)。Rieppel(2000)又认为,由于材料保存不完整,这一标本可以归入 *Nothosaurus* 或另一与其密切相关的属。虽然包括本文所记述的兴义鸥龙在内,目前所报道的贵州兴义竹杆坡段的化石均属始鳍龙目(Eosauropterygia),但竹杆坡段动物群的组成并不如此单调,笔者就曾在贵州博物馆内见到采自兴义的一保存非常完美的海龙类(thalattosaurs)骨架。

始鳍龙类、海龙类、楯齿龙类(placodonts)和鱼龙类(ichthyosaurs)——这些广布于三叠纪西特提斯区的主要海生爬行动物类群,在中国下扬子地区都有发现(Wang et al., 2001),但它们的数量和多样性仍不如西特提斯区丰富。目前中国发现的始鳍龙类仅包括肿肋龙科的胡氏贵州龙、远安贵州龙(*Keichousaurus yuananensis* Young, 1965)和湖北汉江蜥(*Hanosaurus hupehensis* Young, 1972),幻龙下目的 *Nothosaurus* sp.和邓氏三桥龙(*Sanchaosaurus dengi* Young, 1965),及纯信龙下目(Pistosauroidea)的宋氏清镇龙(*Chinchenia sungi* Young, 1965)和东方广西龙(*Kwangsisaurus orientalis* Young, 1959)。这些生活于滨海和浅海的爬行动物,与鱼龙类不同,是靠强壮的桡足在水中划行,推动身体前进。它们是缓慢的游泳者。

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鳍龙超目　Sauropterygia Owen, 1860

始鳍龙目　Eosaurpterygia Rieppel, 1994

真鳍龙亚目　Eusauropterygia Tschanz, 1989

幻龙科　Nothosauridae Baur, 1889

鸥龙属　*Lariosaurus* Curioni, 1847

兴义鸥龙(新种)　*Lariosaurus xingyiensis* sp. nov.

(图1,2)

正模　一近于完整的骨架,古脊椎动物与古人类研究所标本编号 IVPP V 11866。

地点和层位　贵州省兴义;中三叠统法郎组竹杆坡段。

特征　小型鸥龙类,头骨细长,眶前部是整个头长的40%,外鼻孔之前吻的两侧有明显收缩;上颌骨后端伸达上颞孔1/4处的下方;上颞孔长度是眼眶长度的两倍;顶骨平台窄长,松果孔之后形成矢状嵴;肱骨短,其长度是股骨长度的0.75;尺骨近端无明显加宽;腕骨5块。

释名　兴义为化石产地所在市名。

标本描述　骨架基本保存完整,动物的身体扭曲,形象非常生动。头骨和肩带腹面向上保存,颈椎显示左侧视,肩带之后中轴骨逐渐转为背视,腰带压于荐椎之下,尾椎显示右侧视。

头骨遭受背腹向和侧向挤压,右侧各骨与中线各骨片保存在同一平面内,而左前颌骨和左上颌骨的齿缘被压在腹面。总体来看头骨基本完整。头骨小型,细长,头长(吻端—顶脊末端)134mm。由于枕面被压变形,呈近于水平保存的面,吻端—枕髁的长度和吻端—颌关节的长度都可能有些许的延长,但从与之关节的下颌来看,变形的幅度不大。吻部适度发育,眶前部长是整个头长的40%。在外鼻孔前缘一线吻部明显向内收缩。外鼻孔长宽适度,两鼻孔前端互相靠近,其长轴斜向后外侧,后端间距离加大。眼眶宽大,而上颞孔细长,上颞孔长度是眼眶长度的2倍。

前颌骨的背突与鼻骨在外鼻孔中点附近相接。前颌骨吻(premaxillary rostrum)适度发育,外鼻孔之前部分的长度是头骨中线长度的19.6%。表面具稀疏、细小的凹坑雕饰。前颌骨的外侧支在鼻孔前外侧缘与上颌骨相接,这两块骨片环围着外鼻孔。前颌骨齿数为5。左前颌骨齿列保存较好,第1、3、5齿齿冠上部断失,齿冠基部粗壮;第2齿为新生齿,仅见尖细的牙尖;第4齿未保存,留一大的齿孔。牙齿虽大小有别,但都明显地大于上颌骨齿,且均向前下方伸出,呈匍匐状(procumbent fangs)。右前颌骨齿列只保存了第2齿的基部和第4齿的大部分齿冠。牙齿粗壮,与其他牙齿不同,右前颌骨第4齿伸向下方。牙齿表面具细密的纵向条纹。

两鼻骨在中线相遇,占据着外鼻孔与眼孔之间的中心区域。它们阻隔了前颌骨背突与额骨之间的连接。鼻骨表面的凹坑稀疏,但纵向拉长。

额骨愈合为一纵向伸长的骨片。它的前侧方与前额骨,后侧方与后额骨,后方与顶骨相连,占据着眼眶内缘的大部分。前额骨和后额骨适度发育,它们分别占据着眼眶的前内侧缘和后内侧缘。前额骨和鼻骨相连,隔开了额骨与上颌骨。后额骨的后端伸达上颞孔前端之后,但它被眶后骨排除出上颞孔的前缘。其表面的凹坑雕饰最为密集。

左右顶骨愈合,前端伸达上颞孔前缘一线与额骨呈锯齿状缝合。骨片的前部向两侧扩展,间颞区极为窄长。椭圆形的顶孔大致位于顶骨的后 1/3 处,顶孔之后形成一窄的顶脊。

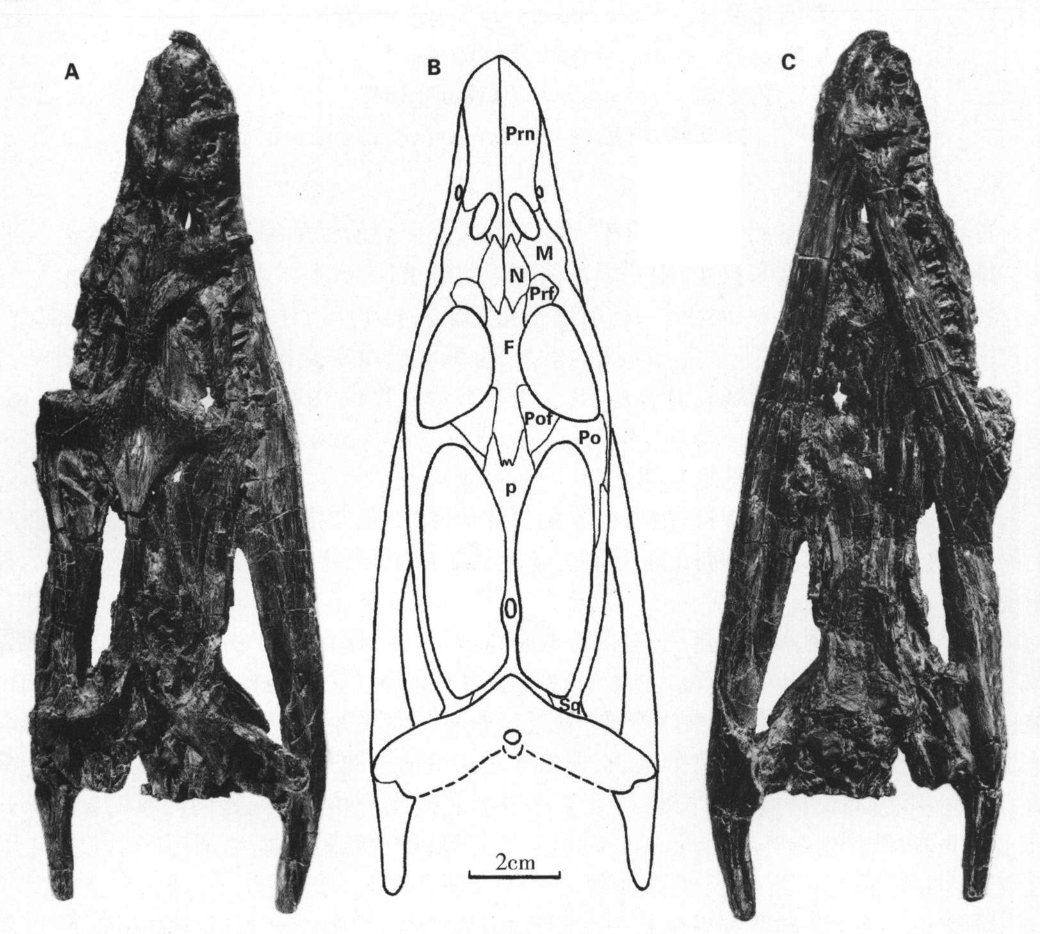


图 1 兴义鸥龙(新种)头骨(IVPP V 11866)

Fig.1 The skull of *Lariosaurus xingyiensis* sp. nov. (IVPP V 11866)

A. 头骨顶视 skull in dorsal view; B. 头骨顶视复原 reconstruction of skull in dorsal view; C. 头骨腹视 skull in ventral view

简字说明 Abbreviations: F. Frontal 额骨; M. Maxilla 上颌骨; N. Nasal 鼻骨; P. Parietal 顶骨; Pm. Premaxilla 前颌骨; Po. Postorbital 眶后骨; Pof. Postfrontal 后额骨; Prf. Prefrontal 前额骨; Sq. Squamosal 鳞骨

上颌骨是一块非常长的骨片,它的上升支与前颌骨、鼻骨和前额骨相连。它细长的后支构成眼眶的外侧缘,向后伸至上颞孔前 1/4 处的下方。与鸥龙其他种相同,在外鼻孔和眼孔之间着生着大的犬齿,不同的是目前只看到一个。右侧犬齿齿尖断失,齿基部粗壮。其后有一新生齿,它自齿孔向前下方伸出,齿尖抵在犬齿的基部。齿尖细小,也许它代表一个新生的犬齿。右犬齿前有 3 个上颌骨齿,它们也明显地小于犬齿。左上颌骨紧接在犬齿之后为一齿孔,在其深处有一刚刚生长的小的牙尖。与右侧的情况一样,这一细小的牙尖也许代表第二犬齿。犬齿之前可见 3 个小的上颌骨齿,但在最前面的一个上颌骨齿

与最后一个前颌骨齿之间有 7mm 的一段距离,很难确定此处是否有另一个上颌骨齿。左侧上颌骨齿列不完整,从保存的牙齿和暴露出的齿孔统计,犬齿后齿的数目大约是 11。右侧可见 10 个犬齿后齿,最后一个上颌骨齿位于上颞弓的 15mm 处。这些牙齿的大小有些差异,但都明显地小于前颌骨齿和犬齿。牙齿表面的纵纹亦不如前颌骨齿和犬齿发育。这样上颌骨齿数最少可达 15。

眶后骨为一相对较大的骨片,它形成眼眶的后缘和上颞孔的前缘。眶后骨内侧与后额骨及顶骨相连,外侧的后突细长,后延至上颞孔的 1/2 处。在左右两侧都未找到与轭骨的骨缝。

鳞骨为一较大的三叉形骨片。它细而长的前侧支,沿上颞孔的外侧缘向前延伸,与眶后骨和上颌骨相接。向内侧伸出的一支与顶骨相接,但二者间的界线不清。它们在顶脊之后形成清楚的枕脊(occipital crest),向两侧后方延伸,清楚地分隔开头骨的顶面和枕面。鳞骨的后下支在枕面的两侧有较大的出露,与上枕骨、后耳骨和方骨相连。

枕面破损严重,各骨骨缝不清,它的右侧被前部颈椎覆压。可以辨识的特征包括:枕面封闭(closed occiput);枕孔适度大小,圆形;枕孔之上在上枕骨和顶骨的部位有一明显的中脊。枕髁在顶视中被环椎遮盖,腹视中可见它受挤压移向左侧。后视可见右侧方骨,它的下端横宽,两个关节髁很好地吻合在下颌关节窝内。外髁大于内髁,外髁的位置高于内髁且前于内髁。颌关节较枕髁位置靠后。未见后颞孔。

头骨腹面基本完整,但有小的错动和裂痕,骨缝不易分辨。由于下颌原位保存,头骨前部前颌骨、上颌骨和锄骨的腹面均无法观察到。右侧内鼻孔露出,占据其后缘的腭骨破损,但大致范围可以确定。翼骨在腹面后部占据了相当大的位置。翼骨的方骨支向侧后方伸出,与方骨相接。翼骨横突与外翼骨相接,后者较为粗壮,被压在下颌齿骨之上(标本腹面向上保存),它显然代表着向下突出的翼骨—外翼骨凸缘(pterygoid-ectopterygoid flange)。基枕骨在翼骨之后有窄的出露,由其形成的枕髁粗大。

下颌保存非常完整,从腹面看侧压明显。左下颌支露出它的外侧面,而右下颌支显示的是它的不完整的内侧。缝合部左下颌支压在右下颌支上。缝合部长 25mm,宽度受保存状态所限无法准确确定。右侧在腹面只有 6mm,左侧自缝合线至齿缘都在同一平面内,宽度达 14mm。估计下颌缝合部的宽度在 14 ~ 16mm。缝合部长与宽之比为 1.79 ~ 1.56。齿骨前部表面有小的凹坑。

齿骨构成下颌外侧面的大部分,它的长度达下颌长度的 2/3。齿骨的腹缘与夹板骨(?)、隅骨,后部与上隅骨相连。它的背缘呈不规则的波状。最前部较低,在(可能是)第 5 个獠齿(fang)的位置升高,向后再次降低,在相对于上颌犬齿的位置最低,下颌的高度仅为 8mm,再向后上缘平直地向上方升起。在其最大高度的部位与冠状骨相接,在下颌的内外侧面都有平直的骨缝。这一部位下颌高度达 18mm,代表着一个适度发育的冠状突。

隅骨是一相当细长的骨片,在关节骨之前加宽,占据下颌后部的腹缘。上隅骨在下颌外表面出露,它与隅骨构成非常发达的反关节突。由关节骨形成的下颌关节窝与一对方骨髁相对应,外侧窝位置明显高而靠前,内侧窝低而靠后。

下颌齿列保存不完整,左下颌前部保存了两个细长的牙齿,经过一段 11mm 的空缺后,是位于齿骨高峰处的一个大的獠齿,此齿粗壮,齿基部直径可达 3.5mm。可惜的是牙齿的上部断失。空缺处可能有两个牙齿脱落。右下颌第 1 齿大部保存,它明显大于左侧

第1、2齿,不完整的齿冠长达13mm。第2、3齿相对较细,第4齿为一从齿孔中刚刚长出的新生齿,它们都明显地大于除犬齿之外的上颌骨齿和后部齿骨齿。第5齿粗壮。这样V 11866的下颌前端就有5个大的獠齿。它们全位于缝合部之内。与其他幻龙类不同的是这些牙齿不呈匍匐状,除右侧第2齿伸向前方外,其余牙齿弯曲向上生长,表面有清晰的纵向纹饰。右侧第6、7齿显著变小,左下颌支大的犬齿型齿后有14个完整或不完整的牙齿保存,但这一数目显然小于它的完整齿数。由于保存的原因,精确的下颌齿数不清。

表1 兴义鸥龙(新种)头骨和下颌测量

Table 1 The measurements of skull and lower jaw of *Lariosaurus xinyiensis* sp. nov. (mm)

头骨 distance from the anterior end of snout	
吻端—顶脊后端 to posterior end of parietal ridge	134
吻端—枕髁 to occipital condyle	153
吻端—颌关节 to lower jaw articulation	160
头骨宽度 width of skull	
外鼻孔前收缩处 across constriction before external naris	15
眼眶后部最宽处 across widest behind orbit	46
下颌关节处 across articulation of lower jaw	62
鼻孔 长×宽 external naris length × width	11 × 5
两鼻孔间最小宽度 smallest width between two external naris	5
眼眶 长×宽 orbit length × width	26 × 13
间眶部最小宽度 smallest width of interorbital region	6
上颞孔 长×宽 upper temporal fenestra length × width	54 × 14
吻端—外鼻孔前缘 distance from anterior end of snout to anterior margin of external naris	29
吻端—眼眶前缘 distance from anterior end of snout to anterior margin of orbit	56
眼眶后缘—上颞孔后端 distance from posterior margin of orbit to posterior end of upper temporal fenestra	64
下颌长 length of lower jaw	186
下颌缝合部长 length of symphysis of lower jaw	25
下颌缝合部宽 width of symphysis of lower jaw	> 14
反关节突长 length of retroarticular process	25

头后骨骼: V 11866的中轴骨连续保存。颈椎、背椎和荐椎极为完整,只有后部尾椎断开,可能有部分缺失。荐前椎44节,其中颈椎18节,锁骨和间锁骨压在第19和第20节椎骨上。环椎和枢椎紧靠头骨之后保存,但方向和位置都略有错动。V 11866的头骨是腹面向上,而颈椎是左侧向上保存的。由于颈椎向头骨右侧移动,使枕髁与环椎的神经弓靠在一起,未见前环椎和环椎的神经棘。环椎的神经弓和间椎体都较粗壮,神经弓的后关节突非常发育。在间椎体之后有一三角形的骨片,推测为单独保存的枢椎间椎体。枢椎的椎体稍短于第3颈椎的椎体,但神经弓的高度与第3颈椎的基本一致。

第3～18颈椎椎体长大于宽(虽然不排除保存时受压变形)。椎体两侧和下缘均有明显收缩,腹面无棱脊(keel)。脊椎彼此连接紧密,只在第7、8节椎间稍微错开,可观察到

椎体为平凹型。神经弓与椎体间骨缝清晰,神经弓稍宽于椎体,背视长稍大于宽。神经棘低,为较薄的片状。前关节突的关节面向内上方、后关节突的关节面向外下方倾斜。辅助椎间关节(accessory intervertebral articulations)存在,但由于脊椎间连接紧密,无法清楚地观察到。颈肋双头,短小,双头均连接到椎体上。

第19～44节为背椎,共26节。它们均顶面向上保存,无法观察到椎体。背椎的神经弓宽大,呈宽大于长的矩形。如第31节荐前椎(第13节背椎)的神经弓宽27mm,长16mm;神经棘低而扁平。背椎横突上的关节面完全位于神经弓上,它有圆凸状的外形,且背腹向伸长。这表明肋骨的头突(capitulum)与脊椎之间有较大的活动性。背肋单头,肋体细长而弯曲,断面近于椭圆形。第25、26背肋形态特殊,它们呈背腹向扁平的板状,末端稍削尖,且斜向后方,趋向荐肋的末端。与前部背椎不同,第25、26节背椎横突的关节面圆形,从微凸至平凹状。

5节荐椎背视与后部背椎非常相似。它们亦有低的神经棘和横宽的神经弓。荐肋为扁平的板状,有宽的近端和稍窄、但强壮的远端。

保存了27节尾椎,其中前21节连续,后7节稍脱离原位。不排除有少量末端尾椎缺失。尾椎右侧向上保存。尾椎椎体平凹型。虽然仅前10节尾椎保存了短的肋骨,但第1～15节尾椎上可见与之相接的关节面。这一近于圆形的凹面位于神经弓和椎体上,二者间的骨缝从凹面的中部通过。未见脉弧。

V 11866在弯曲身体的内侧保存了部分腹肋。它们细而密集,具体数目不详,估计多于20排。每排由一中央"人字形"骨和两侧的侧节组成。

V 11866的肩带保存完好,与其他幻龙类的肩带外形极为相似。单一的间锁骨腹视呈顶角向前的三角形,未见向后方伸出的中央骨棒。间锁骨的另一特征是它明显大于其他幻龙类的间锁骨,其前端阻隔了两锁骨在中线相接(至少在腹面上如此)。锁骨在间锁骨的两侧向左右延伸,后外侧与肩胛骨相连接。肩胛骨的腹面部分扩展,腹中央为一深凹。后外侧与乌喙骨一道形成肩臼(glenoid)。肩胛骨背部由肩胛骨板(scapular blade)缩小形成的后背突细而长。乌喙骨是肩带中最为粗壮的一对骨片,它们在中线相遇,使肩带形成一完整的圆环状。乌喙骨的前端未见明显的乌喙骨孔,只是在相应的部位骨片的边缘有一浅的凹入。

V 11866的荐椎背面向上,右侧腰带无法观察到,仅左侧腰带有部分出露。肠骨为一短粗的骨块。内侧视近四边形,高29mm,上端宽19mm,下端宽21mm。耻骨和坐骨都仅暴露了近端与肠骨相连的部分,无法窥其全貌。从保留的部分看,V 11866的腰带可能与其他幻龙类的腰带构造相同。

左右肱骨都完好保存,只是姿势略有不同。左肱骨腹面向上,各部特征清晰,虽然在保存时可能受压变形。骨干长79mm,较平直,并未像其他幻龙类那样弯曲或形成角度,只是内侧缘稍有凹入。骨体较宽,中部未见收缩,最窄处(20mm)甚至宽于近端宽度(19mm)。远端宽度为21mm。近端背腹向加厚,关节面呈椭圆凸状。远端关节面稍外凸,呈拉长的不规则状。三角胸肌脊(deltopectoral crest)发育,未见明显的内髁孔,在其位置上有一狭长的深凹。肱骨的远端外侧可见平缓的凹入,但未见开放的外髁沟和旋后肌突。尺骨长43mm,近端关节面宽21mm,明显外凸。桡骨长41mm,近端关节面窄而平直,宽度为13mm。它们的远端分别宽16mm和11mm。骨干最小宽度分别为13mm和7mm。

腕骨5块,左侧的原位保存,右侧的略有错动(必须说明由于肩带腹面向上保存,位于身体右侧的是左前肢)。中间腕骨(intermedium)大,半圆形,位于尺骨、桡骨间隙处(spatium interosseum)的远端。尺腕骨(ulnare)稍小,位于尺骨的远端。3块小的远端腕骨(distal carpals 2、3、4)分别对应于Ⅱ、Ⅲ、Ⅳ指。第4远端腕骨与尺腕骨相接,而第2远端腕骨位于桡骨的远端。除第2远端腕骨外,其余各腕骨的表面均明显凹入。

左"手"除第5指外,其余部分保存完整。其中掌骨Ⅰ和Ⅴ稍短,Ⅱ、Ⅲ、Ⅳ掌骨几乎等长。Ⅱ、Ⅲ、Ⅳ指的指节骨排列整齐,愈向远端指节骨愈短。末端为一短钝的指爪骨。第Ⅰ指有一适度长的指节骨,指爪骨似不完整,很小,而且偏离了原位。第Ⅴ指仅保留了一个指节骨,指爪骨未保存,但推测应是存在的,所以该鸥龙的指式为2、4、4、4、2(?)。

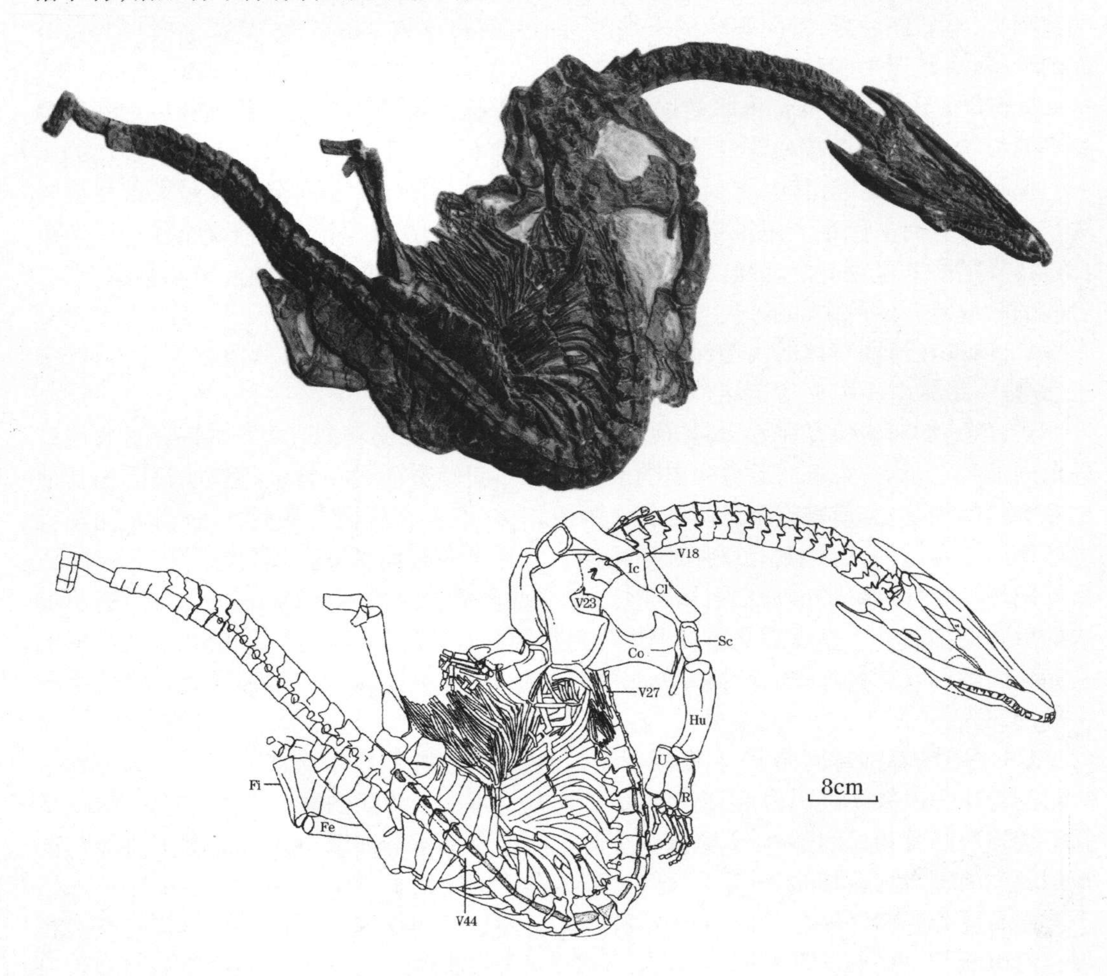


图2 兴义鸥龙(新种)骨架(IVPP V 11866)

Fig.2 The skeleton of *Lariosaurus xingyiensis* sp. nov. (IVPP V 11866)

简字说明 Abbreviations: Cl. Clavical 锁骨; Co. Coracoid 乌喙骨; Fe. Femur 股骨; Fi. Fibula 腓骨; Hu. Humerus 肱骨; Ic. Interclavical 间锁骨; R. Radius 桡骨; Sc. Scapula 肩胛骨; U. Ulna 尺骨; V18 Vertebra 18 第18节脊椎

股骨细长。它的长度105mm,为肱骨长度的1.3倍。近端宽23mm,远端宽19mm,骨

干中部最细处仅11mm。骨干较直，未显S状弯曲。但总体来看与 *Nothosaurus raabi* 的股骨极为相似。内转节(trochanter)适度发育。胫骨、腓骨均不完整。右腓骨保存了大部分，仅远端破损。跗部和“脚”虽有部分骨片，但它们的性质难于确定。

比较与讨论　采自贵州兴义的这一化石骨架(V 11866)的一些特征，如愈合的额骨、强烈收缩的顶骨、发育的枕嵴和上颌犬齿、荐肋的远端不扩展等，表明它可被归入幻龙科。该科目前仅包括2属 *Nothosaurus* 和 *Lariosaurus* (Rieppel, 2000)。V 11866 的头骨特征虽与 *Nothosaurus* 的相符(有些特征是 *Nothosaurus* 和 *Lariosaurus* 所共有的)，但它的头后骨骼却与 *Nothosaurus* 的有很大区别，而与 *Lariosaurus* 的特征一致。如 *Nothosaurus* 仅有3节荐肋，而 V 11866 和 *Lariosaurus* 的荐肋可达5节，它们的远端变细，彼此聚拢；*Nothosaurus* 的间锁骨有一小的后部骨干，而 V 11866 和 *Lariosaurus* 的间锁骨三角形，无后部骨干的痕迹；*Nothosaurus* 的腕骨不超过3块，它们是中间腕骨、尺腕骨和第四远端腕骨(intermedium, ulnare and the fourth distal carpal)，V 11866 和 *Lariosaurus* 的腕骨5块，除了 *Nothosaurus* 所具有的3块外，还有第二和第三远端腕骨。依据头骨和头后骨骼特征 V 11866 可被归入 *Lariosaurus*。

Lariosaurus 是分布于西欧、南欧和中亚的一个属，目前包括6个有效种(Rieppel, 2000)。属型种 *L. balsani* 和 *L. curionii* 的顶骨平台(parietal skull table)在松果孔之后明显收缩，*L. stensioei* 的顶骨呈三角形，*L. buzzii* 的顶骨宽，在松果孔之后没有明显收缩，它们与 V 11866 顶骨平台的形态明显不同。V 11866 和 *L. valceresii* 相似，顶骨平台极为窄长，在松果孔之后不见明显的收缩。V 11866 在上颞孔大小、与眼眶长度的比例上也与 *L. valceresii* 相似，而不同于其他种。它们的上颞孔大，其长度是眼眶长度的2倍。而 *L. buzzii* 和 *L. stensioei* 上颞孔长度与眼眶长度相等，*L. balsani* 和 *L. curionii* 上颞孔长度是眼眶长度的1.4～1.8倍。

综合各项特征来看，V 11866 与产自意大利 Ca' del Frate 和西班牙 Estada 的 *L. valceresii* (Tinotori and Renesto, 1990)最为相似，二者的区别在于 *L. valceresii* 肱骨的外髁沟(ectepicondylar groove)开放，边缘有一明显的旋后肌突(supinator process)(Tintori and Renesto, 1990)。V 11866 肱骨的远端外侧可见平缓的凹入，但未见开放的外髁沟和旋后肌突。*L. valceresii* 的前肢稍长于后肢，肱骨与股骨长度之比为0.96；而 V 11866 的后肢明显长于前肢，肱骨与股骨长度之比为0.75。虽然 *Lariosaurus* 像其他的鳍龙类一样，肱骨具正向的异速生长(positive allometry)，在幼体中这一比值是0.74～0.77，成体中是0.76～0.96(Rieppel, 1998)，但 V 11866 的个体(130cm)大于 *L. valceresii* 的正模(90cm, Italian Governement number: 59781)，它应代表一成年个体，其短的前肢应是它原始性的表现，是它区别于 *Lariosaurus* 其他种的特征。

中国三叠系中幻龙超科的材料还包括前已述及的 *Nothosaurus* sp.和产于贵阳市郊三桥的邓氏三桥龙(*Sanchiaosaurus dengi*)。*Nothosaurus* sp.主要依据不完整头骨鉴定，在头骨特征上与兴义鸥龙存在差异。它的上颞孔相对更大，是眼眶长度的两倍多；顶骨与额骨的骨缝位置更靠后，位于上颞孔前缘之后的相当一段距离。虽然它们的头骨具很大的相似性，但由于 V 11866 被归入鸥龙属主要依据头后骨骼特征(如果仅有头骨，它更像幻龙)，而 *Nothosaurus* sp.没有保存完好的头后骨架，目前很难将其归入兴义鸥龙。邓氏三桥龙虽然保存部分头后骨骼，但与鸥龙属的差异是明显的。

贵州兴义法郎组竹杆坡段的时代存在争议。该段地层在建立之初被确认为中三叠世拉丁早期。杨钟健(1958)和陈宗富(1985)在讨论胡氏贵州龙的时代时与这一观点是基本一致的。王立亭(1996)根据1:5万和1:20万区调成果,认为"竹杆坡组"的时代是晚三叠世卡尼期。王成源等(1998)依据采自胡氏贵州龙产地贵州兴义顶效的牙形刺化石的研究,同样认为竹杆坡段的时代是卡尼期。董卫平等(1997)在对贵州岩石地层进行综合研究时,将法郎组竹杆坡段的时代确定为拉丁晚期—卡尼早期。迄今为止,竹杆坡段中包括了3种海生爬行类——胡氏贵州龙、幻龙未定种和兴义鸥龙,它们分属于肿肋龙科(Pachypleurosauridae)和幻龙科。这两科的成员都生活于欧洲和中亚的中三叠世,至今未发现有晚三叠世的代表。虽然杨钟健(1958)强调胡氏贵州龙比肿肋龙特化,但很难确认中国的3个种同步地都比西特提斯的成员进步。依据脊椎动物的对比竹杆坡段的时代应为中三叠世晚期(Wang et al., 2001)。

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A NEW SPECIES OF *LARIOSAURUS* (SAUROPTERYGIA: NOTHOSAURIDAE) FROM TRIASSIC OF GUIZHOU, SOUTHWEST CHINA

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Key words Xingyi, Guizhou, Middle Triassic, Nothosauridae

Summary

The first Triassic sauropterygian to be described from China was *Keichousaurus hui* (Young, 1958) found in Xingyi, Guizhou. *Shingyisaurus unexpectus*, another sauropterygian found in Xingyi, was referred to the Simosauridae by Young (1965). It was identified as *Nothosaurus* or a closely related genus, and the name *Shingyisaurus unexpectus* was considered a *nomen dubium* (Rieppel, 1998). Here we report a well-preserved specimen from Xingyi, Guizhou Province. It represents the first undoubted specimen and a new species of *Lariosaurus* ever found outside western Tethyan faunal province.

Nothosauridae Baur, 1889
***Lariosaurus* Curioni, 1847**
***Lariosaurus xingyiensis* sp. nov.**
(Figs. 1 ~ 2)

Holotype An almost complete skeleton, institute of Vertebrate Paleontology and Paleoanthropology V 11866 (Figs. 1, 2).

Locality and horizon Xingyi, Guizhou Province, China; Zhuganpo Member of the Falang Formation.

Diagnosis A small-sized species of *Lariosaurus* with a slender skull, length of preorbital

region about 40 % of the skull length; rostral constriction; temporal fenestra twice the size of orbit; maxilla extends backwards to a level below the 1/4 length of the supratemporal fenestra; parietal table narrow; ulna without distinctly broadened proximal head; five ossifications in carpus.

Etymology Referring to Xingyi City in which the fossil locality is situated.

Description The type specimen (IVPP V 11866) is an almost complete and articulated skeleton of Nothosauridae, which curves strongly and exposes different surfaces in different sections of the body—skull, pectoral girdle and forelimb in ventral view; cervical vertebrae in left lateral view; dorsal and sacral vertebrae, pelvic girdle and posterior limb in dorsal view; and caudal vertebrae in right lateral view.

The skull is relatively small and slender. The snout is moderately developed with a distinct rostral constriction at the level of the anterior margin of the external naris. The length of the preorbital region of the skull is nearly 40 % of the skull length. The orbit is large and wide. The supratemporal fossa is narrow and elongate, and twice as long as the orbit.

The external naris is surrounded by the premaxilla and the maxilla. The posterior (nasal) process of the premaxilla meets the nasal at the level of the posterior end of the external naris. There are 5 fangs on the premaxilla, they are distinctly larger than the maxillary teeth. All the teeth are procumbent, and bear longitudinal striations on their surface.

The nasals meet each other along the midline of the skull, they occupy the central area between the external nares and the orbits, and separate the dorsal process of the premaxilla from the frontal.

The frontal is unpaired. It contacts the parietal posteriorly, prefrontal antero-laterally and postfrontal postero-laterally. The latter two bones are moderately developed, and occupy the antero-medial corner and postero-medial corner of the orbit respectively. The parietal is unpaired, and meets the frontal in a deeply interdigitating suture at the level of the anterior margin of the upper temporal fenestra. Anteriorly, the parietal is broad, but gradually narrows to form a distinct parietal ridge. The pineal foramen is a small oval opening, situated near the 2/3 length of the parietal.

The maxilla is a comparatively long bone with its posterior end extending to 1/4 length of the supratemporal fenestra. Each maxilla bears a big canine between the external naris and the orbit as in other *Lariosaurus*, but there is only one big canine. A new tooth just behind the right canine is erupting from an alveolar, which points antero-downwards and contacts the middle part of the canine. The tooth is possibly the neonatal second canine. On the right maxilla there are 3 and 10 teeth anterior and posterior to the canine respectively. They are 3 and 11 on the left. So the least number of the maxillary teeth is 15.

The postorbital is relatively large, forming the posterior margin of the orbit, and anterior and antero-lateral margin of the supratemporal fenestra. It contacts the postfrontal and the parietal medially, the maxilla laterally, and the squamosal posteriorly. The jugal cannot be observed on either side of the skull.

The squamosal is a large tripartite (triadiate) element. Its anterolateral ramus extends along the lateral margin of the supratemporal fenestra until meeting the postorbital at the mid-point of the fenestra. The medial branch of the squamosal and the parietal meet each other at the posterior margin of the supratemporal fenestra. They form a distinct occipital crest, marking a sharp transition between the dorsal and occipital surface. The lower part of the squamosal is an important element of the occipital plate as it stretches downwards to join the supraoccipital, opisthotic and the quadrate.

The occiput is closed, and the foramen magnum is rounded and of moderate size. A sagittle crest extends from the foramen magnum to the top of the occiput. Posterolateral to the occiput is a clear exposure of the right quadrate. Its two distal condyles, the lateral one being larger than the medial one, articulate with the corresponding facets of the lower jaw.

The palatal surface with slight cracks is almost completely preserved, but the sutures between the palatine and the pterygoid are difficult to establish. Behind the symphyseal region of the lower jaws, a small portion of the right internal naris is exposed. The posterior margin of the naris is lined

by the palatine, a damaged bone. The pterygoid is a large bone with its quadrate ramus extending postero-laterally to meet the quadrate. And its transverse process joints the ectopterygoid to form the pterygoid-ectopterygoid flange. The large occipital condyle can be observed at the end of skull, but it is located slightly left to its original position.

The lower jaws are completely preserved. The symphyseal region is spoon-shaped, and 25mm long. Different from other nothosaurs, V 11866 seems to bear a coronoid process. The dentary is long and narrow, almost reaching to 2/3 length of the lower jaw. The angular is a narrow and long bone, with its tapered anterior end inserting between the dentary and splenial, and its posterior portion transversely broadened below the jaw articulation. The surangular, as the most posterior bone, forms the lateral articulation facet and the majority of the retroarticular process, which is long and straight. It bears a lateral shelf like other nothosaurs.

The total number of the lower jaw teeth cannot be ascertained. But it definitely has 5 fangs in the front part of the jaw. The direction of fangs, except the right 2nd, which is shed from its alveolar, is upright. Their crowns curve in various degrees. Fourteen complete or broken small teeth are present on the left jaw, which are less than the number of a complete dentition.

Postcranial skeleton: The vertebral column is preserved in almost perfect articulation in specimen V 11866. Eighteen vertebrae are identified as cervicals. Only the last two cervical ribs (the 17th, 18th) are preserved showing short body and two heads separated by a narrow gap. The rib is supposed to articulate with the centrum only. There are 26 (from 19th to 44th) dorsal vertebrae. The dorsal ribs are gently curved with a single proximal head and a long thick body. Five sacral vertebrae are similar to the posterior dorsal vertebrae in having a low neural spine and a wide neural arch. The sacral ribs show a broad proximal head and a tapering, blunt distal tip. There are 27 caudal vertebrae, of which posterior 7 are eroded and displaced from their natural position. Gastralia are well developed, and distributed densely between the pectoral and pelvic girdle.

In V 11866 the shoulder girdle is well preserved and exposed in ventral view, which resembles that of other nothosaurs in contour. The interclavicle is a triangular bone with a straight posterior margin, it shows no rudiment of a posterior stem. The clavical is a massive element, which runs antero-medially to meet the interclavical, but seems not to contact its counterpart at least on the ventral surface. The scapula is of the ordinary sauropterygian type, with an expanded ventral portion and a posterodorsally slanting dorsal process. The large coracoid contacts the scapula laterally and meets its counterpart in the mid-line to reinforce the anterior union of the clavical and the interclavical. Only part of the left pelvic girdle is exposed, which suggests great similarities to the pelvic girdle of other nothosaurs.

Two humeri are well preserved, of which the left one shows its ventral surface clearly. The shaft of the bone (79mm long) is relatively straight, and not so curved or "angulated" as that of other nothosaurs though its postaxial side is slightly concave. A well-developed deltopectoral crest is present near its proximal end, a distinctive insertional crest for the latissimus dorsi muscle projecting from its postaxial surface. There is no distinctive entepicondylar foramen, but there is a narrow concave depression in its position. A flat depression is visible on the outer surface of the distal end, there is no open ectepicondyle groove or supinator process. The ulna is a little longer than the radius. The width of the ulna is 21 mm at the proximal articular surface, 13 mm in mid-diaphysis, and 16 mm at distal end. The corresponding width of the radius is 13 mm, 7 mm, and 11 mm. The carpus in V 11866 comprises 5 ossifications: the intermedium is a large semicircular bone located distal to the spatium interosseum, the ulnare is the 2nd large element located distal to the ulna, and thd 2nd, 3rd and 4th distal carpals are much smaller elements located proximal to metacarpals II, III and IV respectively. The manus of V 11866 is well preserved, with digits I-IV complete and the V missing its distal phalange. It has a formula of 2 4 4 4 2(?).

The femur is relatively long, slender, and somewhat expanded at both ends, with a straight

shaft. An internal trochanter is present. It is difficult to describe the tibia, fibula, tarsus and pes due to their incomplete preservation.

Discussion This specimen represents a new taxon of Nothosauridae for having its frontals fused, parietal skull table strongly constricted, occipital crest present, maxillary canines present; sacral ribs without distal expansion (Rieppel, 2000). The family Nothosauridae only includes *Nothosaurus* and *Lariosaurus*. Although the skull of V 11866 is similar to *Nothosaurus*, it is distinguished from *Nothosaurus*, and could be identified as *Lariosaurus* based on the characters of the postcranial skeleton: 5 sacral ribs, interclavical of triangular shape without any trace of a posterior stem, 5 ossifications in carpus, hyperphalangy present in manus (second digit). The genus *Lariosaurus* is distributed in western and southern Europe and Middle East, it includes six valid species (Rieppel, 1998, 2000). The parietal skull table of *L. balsani* and *L. curionii* show a pronounced constriction behind the pineal foramen; the parietal of *L. stensioei* is triangular in dorsal view; the parietal of *L. buzzii* is wide, without a pronounced constriction behind the pineal foramen. These characters are distinctly different from those of V 11866. The parietal skull table of V 11866 is similar to that of *L. valceresii*, it is slender, without pronounced constriction behind the pineal foramen. The new species has a large upper temporal fossa, which is twice the size of the orbit. This is similar to *L. valceresii* but different from other species.

The new species is more similar to *L. valceresii* than to other species. However the ectepicondyle groove and the supinator process are absent in *L. xingyiensis*, but present in *L. valceresii* (Tintori and Renesto, 1990). The humerus is much shorter than the femur in *L. xingyiensis*, but nearly equal in *L. valceresii*. The humerus grows with positive allometry in *Lariosaurus* as in all other sauroptergians. Dividing humerus length by femur length yields 0.74 ~ 0.77 in juvenile *Lariosaurus*, and 0.76 ~ 0.96 in adult (Rieppel, 1998). But IVPP V 11866 (130 cm) is longer than the holotype of *L. valceresii* (90 cm), so it represents an adult individual, the short forelimb is a plesiomorphy character, it can be used in distinguishing *L. xingyiensis* from other *Lariosaurus*.

The age of Zhuganpo Member, Falang Formation is under debate. It was regarded as early Ladinian of Middle Triassic when this Member was recognized (Wang et al., 1963). It was accepted by Young (1958) and Chen (1985). But the age was considered as Carnian based on the regional survey (Wang, 1996), which was confirmed by the study of conodonts from the same location and layer yielding *Keichousaurus* in Dingxiao, Xingyi (Wang et al., 1998). Three marine reptiles species have been found in Zhuganpo Member, Falang Formation up to now, they are *Keichousaurus hui*, *Nothosaurus* sp., and *Lariosaurus xingyiensis*. They belong to Pachypleurosauridae and Nothosauridea respectively. Other members of these two families are found in the Middle Triassic of Europe or Middle East, but none is found in the Late Triassic. Although Young (1958) suggested that *Keichousaurus hui* is more specialized than *Pachypleurosaurus*, it is difficult to decide if these three species in China are all more derived than those of the same family in Europe. The age of Zhuganpo Member is regarded as late Middle Triassic based on the correlation of fossil reptiles.

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